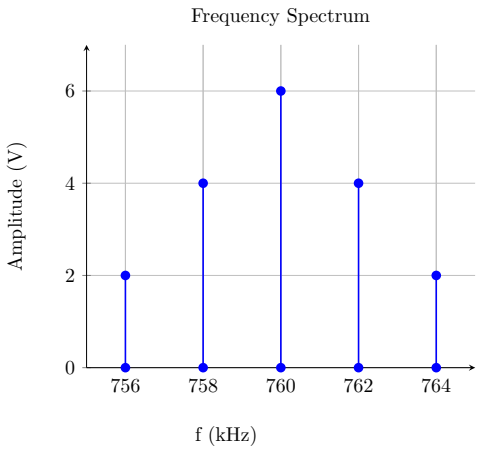
1. This problem walks through the synchronous demodulation process. Given the following AM amplitude spectra:

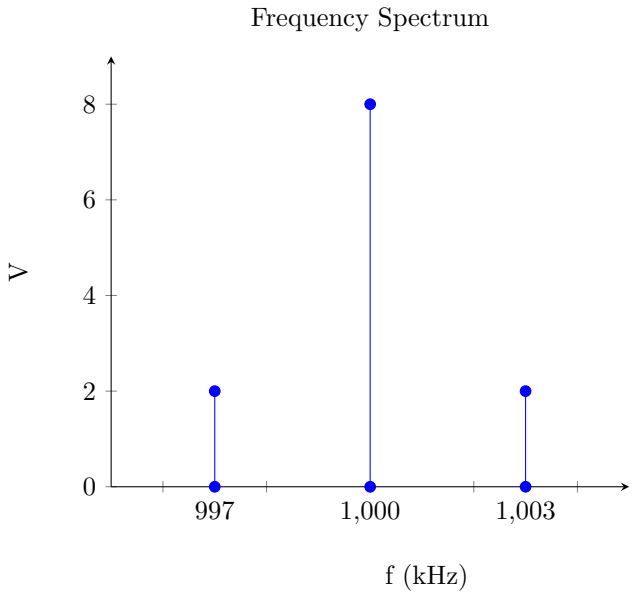


(a) Draw the amplitude spectra after multiplying this signal by $2\cos(2\pi(760\,\text{kHz})\,t)\,\text{V}$.

(b) Modify the drawing of Part (a) by folding the negative frequency amplitudes over to the positive frequencies (this will double the amplitudes of the positive frequency components).

(c) If the signal from Part (b) is used as the input to an LPF with cutoff frequency of 10kHz and a HPF with a frequency of 10Hz, plot the resulting amplitude spectra.

2. Given the following amplitude spectra with a single message tone:



(a) If $A_c = 4$V, find B, A_m, and α, and determine if the signal is under or over-modulated.

$B =$

$A_m =$

$\alpha =$

Circle one: Over-modulated Under-modulated

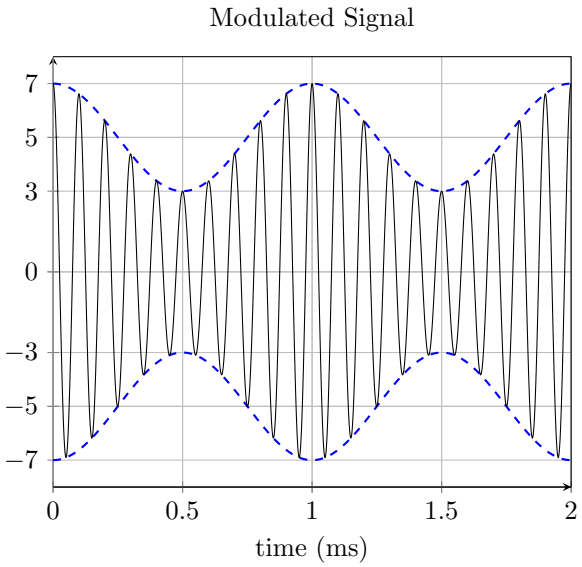
(b) What will be the V_{max} and V_{min} of the time time-domain graph?

$V_{max} =$

$V_{min} =$

(c) Design a suitable envelope detector.

3. Given the following time-domain under-modulated AM signal, which contains a single message tone.



(a) Determine the frequency of the message tone (note the scale of the x-axis). $f_m =$

(b) Estimate the frequency of the carrier. $f_c =$

(c) If the carrier amplitude is 1V, compute the values of B and A_m. $B =$

$A_m =$

(d) Design a suitable synchronous detector. What will be the expression ($A\cos(2\pi ft)$) at the output of the detector? Use a 2 V local oscillator.